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(54) **Apparatus for making a container closure assembly**

Vorrichtung zur Herstellung einer Behälterverschlussanordnung

Appareil pour fabriquer un ensemble de fermeture de récipient

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates in general to metal drum fabrication and the insertion die tooling associated with this fabrication. The present invention more specifically relates to the configuring of the drum end with an installed, internally-threaded flange and the associated insertion die tooling. The referenced flange is constructed and arranged for receipt of an externally-threaded closing plug. The present invention relates to the construction and arrangement of the insertion die tooling and modifications to that tooling that relate directly to the installation of the flange into an embossment formed in the metal of the drum end.

[0002] Prior to loading the drum end onto a corresponding work station of the insertion die tooling, the metal drum end is formed with the embossment which provides a shaped annular pocket that is constructed and arranged to receive the flange. Thereafter, in terms of the fabrication sequence, the metal of the drum end is formed over, under, and around the flange so as to securely anchor the flange into the drum end. This basic construction method and configuration is well known in the industry and represents technology that has been practiced for several years. Traditionally, the initial forming of the drum end pocket or embossment included an outer annular wall that had a generally cylindrical shape and an upper, substantially planar panel that was substantially perpendicular to the outer annular wall. In this final configuration, the drum end material does not extend into the open interior defined by the flange outer wall.

[0003] This flange and drum end construction and structural relationship is described generally in U.S. Patent No. 5,943,757, in the context of a new one-step insertion die. The '757 patent issued August 31, 1999 to Magley and is incorporated by reference herein in its entirety. One difference between the '757 patent and prior art fabrication methods and tooling is the forming of the embossment as one step in the overall sequence as contrasted to having that embossment pre-formed in the drum end prior to loading the drum end onto the lower work station. Importantly, in the context of the present invention, neither the '757 patent nor the prior art installation constructions for metal flanges disclose any inner axial wall being formed as part of the drum end. The reference to "inner" refers to an axial wall being formed on the inside of the flange. While the basics of the crimping procedure so as to install a flange into the drum end pocket or embossment are believed to be well known, this fabrication is performed without the use of any inner axial wall for these types of metal flanges.

[0004] In U.S. Patent No. 4,588,103, a plastic closure (20), shaped as an internally-threaded flange, is installed into boss (41) that is formed in the metal drum end (42) as illustrated in FIG. 2 of the '103 patent. The insertion tooling illustrated in FIG. 5 of the '103 patent includes a center holding and forming die (53) which is of annular shape and contoured along its lower surface so as to fit snugly up against upper wall (45) after forming inner wall (44) of boss (41). Inner wall (44) and outer wall (43) are substantially concentric with one another. Center annular portion (55) helps to form inner wall (44) and is positioned against inner wall (44) as the crimping members or collets (54) act on boss (41). Importantly, the center annular portion (55) is cylindrical.

[0005] In U.S. Patent Application Serial No. 10/971,874, filed October 22, 2004 and published December 8, 2005 as Publication Number US-2005-0269330-A1, an inner annular wall is formed in a metal drum end as a part of the overall insertion construction for a metal, internally-threaded flange. The forming of the drum end includes shaping an outer annular wall that is generally cylindrical, an upper, generally planar panel, and the inner wall. As illustrated in FIG. 10 of the '874 application, the inner wall (27) is inwardly and downwardly tapered into a frustoconical form. The insertion of the metal flange into the drum end and its final installation involves the application of opposing inner and outer forces directed against portions of the drum end material.

[0006] The present disclosure is directed to an improvement in the insertion die tooling by changing the cylindrical form of the center annular portion or pilot into a frustoconical form. As one example of a pilot, refer to portion (55) in the '103 patent. This same modification, according to the present disclosure, would be applicable to any prior art insertion die tooling where a cylindrical center form or pilot is used for the shaping of a generally cylindrical inner wall. This particular change in the insertion die tooling results in an improved structure as compared to an inner tooling form that is cylindrical. One benefit derived from the present disclosure is the ability to change the thickness of the drum end material without having to change the insertion die tooling for proper installation of the flange.

BRIEF SUMMARY

[0007] Insertion die tooling for the installation of a flange into a drum end embossment according to the present invention comprises a work station constructed and arranged to receive an internally-threaded metal flange and a portion of a metal drum end, the metal drum end being formed with an embossment to be positioned over the metal flange and a movable pressure unit including a closing collet, a punch holder attached to a closing ring, and a pilot that is constructed and arranged to be movable with movement of the punch holder, the pilot including a frustoconical portion constructed and arranged for engagement with the embossment for forming an inner drum end wall adjacent an inner surface of the flange.

[0008] One object of the present disclosure is to describe improved insertion die tooling for the installation

of a flange into a drum end embossment.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009]

FIG. 1 is a front elevational view, in full section, of insertion die tooling in an open position according to a typical embodiment of the present invention.

FIG. 2 is a front elevational view, in full section, of the FIG. 1 insertion die tooling in a closed position with a flange and drum end inserted.

FIG. 3 is a front elevational view, in full section, of a drum end embossment formed prior to placing the drum end in the insertion die tooling.

FIG. 4 is a front elevational view, in full section, showing the final installation of the flange into the embossment as shaped by the FIG. 1 insertion die tooling.

DETAILED DESCRIPTION

[0010] For the purposes of promoting an understanding of the disclosure, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same.

[0011] Referring to FIGS. 1 and 2, there is illustrated insertion die tooling 20 according to the present disclosure. The present disclosure describes a preferred embodiment of the invention. Tooling 20 includes a stationary, lower work station 21 and an axially movable upper pressure unit 22. The lower work station 21 is constructed and arranged for receipt of the flange 24 and a portion of the drum end 23. The preferred embodiment is illustrated for a three-quarter inch (¾") flange 24 which represents the typical type of flange for the venting location of the drum. It is expected that a second work station will be included for installation of a two inch (2") flange that is used for a dispensing closure. As illustrated and described in U.S. Patent No. 5,943,757, providing two work stations, one for the two inch flange and one for the three-quarter inch flange, enables use of the same type of pressure unit, a portion of which is shown as unit 22, and the same (simultaneous) sequence of installation steps. For the purposes of this disclosure, the insertion die tooling 20 for a two inch flange 24 is selected and illustrated. The same basic structure and steps would apply for the three-quarter inch flange, simply scaled dimensionally for proper sizing. It is also to be understood that combining the two work stations provides added efficiency since the entire drum end 23, in one step, is able to be loaded onto both work stations, concurrently, and both flanges installed with substantially the same process steps and sequence.

[0012] FIG. 1 illustrates insertion die tooling 20 in what is described as an "open" position prior to the loading of the flange 24 and prior to placement of the drum end 23 over the flange within the tooling 20. FIG. 2 illustrates insertion die tooling 20 in what is described as a "closed" position after all of the forming and installing steps have been performed. In progressing from the FIG. 1 position to the FIG. 2 position, the selected flange 24 is placed into receiving pocket 27 that is defined by fixture 28. Fixture 28 in turn is assembled into position on base 29 that forms part of the lower work station 21. When the drum end 23 is formed for receipt of flange 24 by a one-step insertion die, as that disclosed in U.S. Patent No. 5,943,757, the drum end 23 arrives at work station 21 with a substantially flat or planar interior portion that will be formed to receive the two inch and three-quarter inch flanges. When the drum end is not formed by a one-step insertion die, the drum end 23 is pre-formed with a flange-receiving embossment 30, as illustrated in FIG. 3.

[0013] The flange 24, as positioned in pocket 27, is centered on axial centerline 31 that extends through the axial (geometric) center of pocket 27 and through the axial center of the pilot 32 that is assembled into the pressure unit 22 and is surrounded by closing collet 33. The closing collet 33 actually consists of a series of individual collet sections or segments, referred to herein as closing collets 33. The flange 24 includes an upper surface 34 and an inner (un-threaded) annular wall 35 (see FIG. 4). The inside diameter of wall 35 is larger than the inside diameter of the opening 36 of the embossment 30. Opening 36 is substantially circular with an axial centerline 37 that is substantially coincident with centerline 31. In this way, the radial lip 38 of embossment 30 extends inwardly toward centerline 37 beyond the inner, annular surface 35a of annular wall 35. In the prior art designs for the metal flange and drum end combination, the radial lip 38 of the embossment 30 did not extend (in the final assembly) beyond the inside surface of the annular wall of the metal flange. This is shown in U.S. Patent No. 5,943,757 in FIG. 5A.

[0014] Assuming that the outside diameter of the two inch metal flange remains substantially the same and assuming that the flange inside diameter, at its upper surface, stays substantially the same, then by reducing the size of the opening 36 of embossment 30, there is sufficient material to form over into an inner annular wall that extends downwardly into the interior of the flange away from the flange upper surface. This inner drum end wall is illustrated in U.S. Patent Application Serial No. 10/971,874. An inner drum end wall, for a plastic closure flange, is disclosed in U.S. Patent No. 4,588,103.

[0015] In U.S. Patent No. 4,588,103, the center annular portion (55) that moves axially into the opening defined by the inner wall (44) of the drum end (42) is cylindrical. In a similar manner, the inserting portion or pilot for the angled inner wall of U.S. Patent Application Serial No. 10/971,874 can be cylindrical. The diameter of this axially-moving pilot in turn helps to determine if there is any angle of incline of the inner drum end wall and if there is, the details of its frustoconical shape, including the final dimensions. Since the angled or inclined inner wall influences gasket compression and release, the angle of in-

cline and the inside diameter sizes of the inner wall along its axial length are important.

[0016] The insertion die tooling 20 provides a novel and unobvious change to the prior cylindrical form of the pilot that was used for a plastic closure flange. Insertion die tooling 20 includes a pilot 32 that is constructed and arranged with a frustoconical surface 41 that is adjacent to and pushes against the radial lip 38 of drum end material in the process of creating the frustoconical inner drum end wall 42. The pilot is surrounded by a series of six closing collets 33 that pivot inwardly to push the drum end material beneath the flange lip 43 and against the outer edge 44 of the flange lip 43. While the closing collets 33 are pivoting inwardly, the pilot 32 is moving in a downward axial direction so as to push downwardly and outwardly on the frustoconical inner drum end wall 42. These opposing inner and outer forces tightly secure the metal of the drum end 23 in, over, under, and around the flange 24, specifically the flange lip 43 and wall 35. As was noted in U.S. Patent Application Serial No. 10/971,874, these opposing forces that act against each other also provide a type of back-up support for each other, enabling much higher compression forces to be applied, as compared to the prior art structures for a metal flange that do not include an inner annular wall. As such, any serrations that might be included about the outer surface of the flange lip are not required for a tight and securely installed flange 24 into the drum end 23 embossment 30.

[0017] With continued reference to FIGS. 1 and 2, the pressure unit 22 further includes a punch holder 47 that is assembled to a closing ring 48 by three, equally-spaced socket head cap screws 49. A socket head cap screw 50 extends through the punch holder 47 and threads into the upper portion 51 of pilot 32, generally concentric with axial centerline 52. Cylindrical pockets 53 are machined into the punch holder 47 and receive springs 54 that assist in the movement of the closing collets 33. The closing collets 33 float within the hollow interior of the closing ring 48 and are captured by their shape and by the shapes of the surrounding parts, including the closing ring 48, punch holder 47, and pilot 32. As would be understood from U.S. Patent No. 5,943,757, downward movement of pressure unit 22 initially places the lower surface 58 of each collet 33 directly against the upper surface 59 of the drum end 23 just immediately to the outside of the outer edge 44 of flange lip 43. Based upon the FIG. 1 illustration, the pilot 32 has not yet moved fully into the flange.

[0018] The next step in the process is for the punch holder 47 and closing ring 48 combination (i.e., assembled together with cap screws) to move axially toward the drum end 23 and flange 24. As this movement occurs, the angled face 60 of the closing ring pushes inwardly on the contacted face 61 of each collet. This causes each collet 33 to pivot its lower edge inwardly, drawing drum end material inwardly below the flange lip 43. The axial movement of punch holder 47 means the same axial movement for pilot 32. The pilot 32 first contacts the inner edge of the radial lip 38 of the drum end that defines upper opening 36. With continued axial travel of pilot 32, the inner wall 42 is formed as the pilot pushes downwardly and outwardly against inner wall 42. This outwardly directed force is applied concurrently with the inwardly directed force from the collets 33. As described, these opposing forces and the back-up reinforcement or support provided by the pilot 32 enables significantly higher compressive forces to be applied to the drum end material that extends around the inside and outside of flange 24.

[0019] The corresponding tooling 20 is novel and unobvious in terms of its structure and use. Creating a frustoconical form 41 for that portion of the pilot 32 that forms the inner wall 42 is an improvement. Further, the ability to use that frustoconical form as a back-up reinforcement and as a way to generate an outwardly directed force is an improvement.

[0020] A further benefit has been identified as a result of the frustoconical form for that portion of the pilot 32, as contrasted to a pilot construction that employs a cylindrical form. When the flange design and its installation into a drum end embossment would permit a thinner drum end material to be used, that would result in a cost savings. One reason that a thinner material would be acceptable is due to the higher compressive forces that can be used. The question then is whether the insertion die tooling can remain the same as the material thickness changes and becomes thinner or changes back to a thicker form. A critical factor in this analysis is the addition of the inner drum end wall 42.

[0021] When an inner annular drum end wall is included as part of the flange installation construction, an inside diameter opening is created, shown as D_1 in FIG. 4. When a generally cylindrical pilot is used, typical of the known prior art, its outside diameter is fixed and is the same throughout is axial extent or length. This outside diameter helps to define the magnitude of the outwardly directed forces and the degree of interference with the inner wall 42. When the drum end material is made thinner, then in order to form and compress the inner wall 42 in the desired manner, the cylindrical size of the pilot needs to be increased to match the D_2 dimension (see FIG. 4). Varying or changing the axial depth of insertion of the cylindrical pilot into the flange does not affect the condition created by the size difference. If the pilot size is not changed for the thinner drum end material, then the inner wall 42 will not be fully formed in the desired manner. By changing the insertion die tooling 20 to include a frustoconical portion 41 as part of the pilot 32, changes in the drum end material thickness can be accommodated without the need to change or redesign the tooling. Since the diameter size of portion 41 increases as the frustoconical taper diverges in a direction away from the flange, all that would need to be done is to insert the pilot farther into the flange so as to achieve the intended design form to inner wall 42 and to exert the desired outwardly directed force.

[0022] In terms of the axial travel of pilot 32 and accordingly of frustoconical surface 41, an interesting effect occurs. With a thinner drum end material, the upper surface of the radial lip 38 material that extends over flange lip 43 is lower, i.e., closer to the flange lip 43. This in turn means that before the lower surface of the collets 33 contact the upper surface of the radial lip, the pressure unit must axially travel a little farther, this added distance corresponding to the reduction in thickness. This then means that that the starting position of the pilot 32 and surface 41 is a little farther in the direction of the flange. The axial travel of the punch holder 47 and closing ring 48 combination can remain substantially the same, but the pilot actually goes deeper into the flange for an increased amount of travel that generally corresponds to the change in the material thickness of the drum end. While there is not a 1:1 correlation due to the frustoconical angle of taper, it is very close considering the magnitude of the dimensional changes to the drum end material thickness.

[0023] While the preferred embodiment of the invention has been illustrated and described in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that all changes and modifications that come within the scope of the claims are desired to be protected.

Claims

1. Insertion die tooling (20) for the installation of a flange (24) into a drum end embossment (30), said insertion die tooling comprising:

   a work station (21) constructed and arranged to receive an internally-threaded metal flange and a portion of a metal drum end, said metal drum end being formed with an embossment to be positioned over said metal flange; and
   a pressure unit (22) including a closing collet member (33), a punch holder (47) attached to a closing ring (48) and a pilot (32) that is constructed and arranged to be movable with movement of said punch holder, **characterised in that** said pilot includes a frustoconical portion (41) constructed and arranged for engagement with said embossment for forming an inner drum end wall adjacent an inner surface of said flange.

2. The insertion die tooling of claim 1 wherein said pilot includes an axial centerline and said work station being constructed and arranged for centering said flange on said axial centerline.

3. The insertion die tooling of claim 1 or 2 wherein said pressure unit further includes a plurality of springs that are constructed and arranged to assist in movement of said closing collet member.

4. The insertion die tooling of any of the preceding claims wherein said collet member includes a plurality of collet segments.

5. The insertion die tooling of any of the preceding claims wherein the work station is stationary, the pressure unit is moveable, and the closing collet is constructed and arranged with a plurality of collet segments.

6. The insertion die tooling of claim 5 wherein said movable pressure unit further includes a plurality of springs that are constructed and arranged to assist in movement of said plurality of collet segments.

Patentansprüche

1. Einsetzprägewerkzeug (20) für die Installation eines Flansches (24) in einer Zylinderendenausbuchtung (30), während das Einsetzprägewerkzeug umfasst:

   eine Arbeitsstation (21), die konstruiert und angeordnet ist, um einen mit einem Innengewinde versehenen Metallflansch und einen Bereich eines Metallzylinderendes aufzunehmen, während das Metallzylinderende mit einer Ausbuchtung ausgebildet ist, die über dem Metallflansch angeordnet wird, und
   einer Druckeinheit (22), die ein schließendes Spannzangenelement (33), einen Stempelhalter (47), der an einem Verschlussring (48) angeordnet ist, und einen Führungszapfen (32) umfasst, der konstruiert und angeordnet ist, um mit der Bewegung des Stempelhalters bewegbar zu sein, **dadurch gekennzeichnet, dass** der Führungszapfen einen kegelstumpfförmigen Bereich (41) aufweist, der konstruiert und angeordnet ist, um mit der Ausbuchtung zum Ausbilden einer inneren Zylinderendenwand in Eingriff zu gelangen, die benachbart zu einer inneren Oberfläche des Flansches ist.

2. Einsetzprägewerkzeug gemäß Anspruch 1, wobei der Führungszapfen eine axiale Mittellinie beinhaltet und die Arbeitsstation konstruiert und angeordnet ist, um den Flansch auf der axialen Mittellinie zu zentrieren.

3. Einsetzprägewerkzeug gemäß Anspruch 1 oder 2, in dem die Druckeinheit weiterhin eine Mehrzahl von Federn beinhaltet, die konstruiert und angeordnet ist, um die Bewegung des schließenden Spannzangenelements zu unterstützen.

4. Einsetzprägewerkzeug gemäß einem der vorhergehenden Ansprüche, in dem das Spannzangenelement eine Mehrzahl von Spannzangensegmenten

aufweist.

5. Einsetzprägewerkzeug gemäß einem der vorhergehenden Ansprüche, in dem die Arbeitsstation stationär ist, die Druckeinheit bewegbar und die schließende Spannzange mit einer Mehrzahl von Spannzangensegmenten konstruiert und angeordnet ist.

6. Einsetzprägewerkzeug gemäß Anspruch 5, in dem die bewegbare Druckeinheit weiterhin eine Mehrzahl von Federn umfasst, die konstruiert und angeordnet ist, um die Bewegung der Mehrzahl der Spannzangensegmente zu unterstützen.

Revendications

1. Outillage de matrice d'insertion (20) pour l'installation d'une bride (24) dans un bossage d'extrémité de fût (30), ledit outillage de matrice d'insertion comprenant :

un poste de travail (21) réalisé et agencé pour recevoir une bride métallique filetée intérieurement et une partie d'une extrémité de fût métallique, ladite extrémité de fût métallique comportant un bossage à positionner sur ladite bride métallique ; et
une unité de pression (22) comprenant un élément de pince de fermeture (33), un support de poinçon (47) fixé à une bague de fermeture (48) et un pilote (32) qui est réalisé et agencé de manière à se déplacer avec le déplacement dudit support de poinçon, **caractérisé en ce que** ledit pilote comprend une partie conique tronquée (41) réalisée et agencée pour une mise en prise avec ledit bossage pour former une paroi d'extrémité de fût interne adjacente à une surface intérieure de ladite bride.

2. Outillage de matrice d'insertion selon la revendication 1, dans lequel ledit pilote comprend une ligne médiane axiale et ledit poste de travail est réalisé et agencé pour centrer ladite bride sur ladite ligne médiane axiale.

3. Outillage de matrice d'insertion selon la revendication 1 ou 2, dans lequel ladite unité de pression comprend en outre une pluralité de ressorts qui sont réalisés et agencés pour faciliter le déplacement dudit élément de pince de fermeture.

4. Outillage de matrice d'insertion selon l'une quelconque des revendications précédentes, dans lequel ledit élément de pince comprend une pluralité de segments de pince.

5. Outillage de matrice d'insertion selon l'une quelconque des revendications précédentes, dans lequel le poste de travail est fixe, l'unité de pression est mobile, et la pince de fermeture est réalisée et agencée avec une pluralité de segments de pince.

6. Outillage de matrice d'insertion selon la revendication 5, dans lequel ladite unité de pression mobile comprend en outre une pluralité de ressorts qui sont réalisés et agencés pour faciliter le déplacement de ladite pluralité de segments de pince.

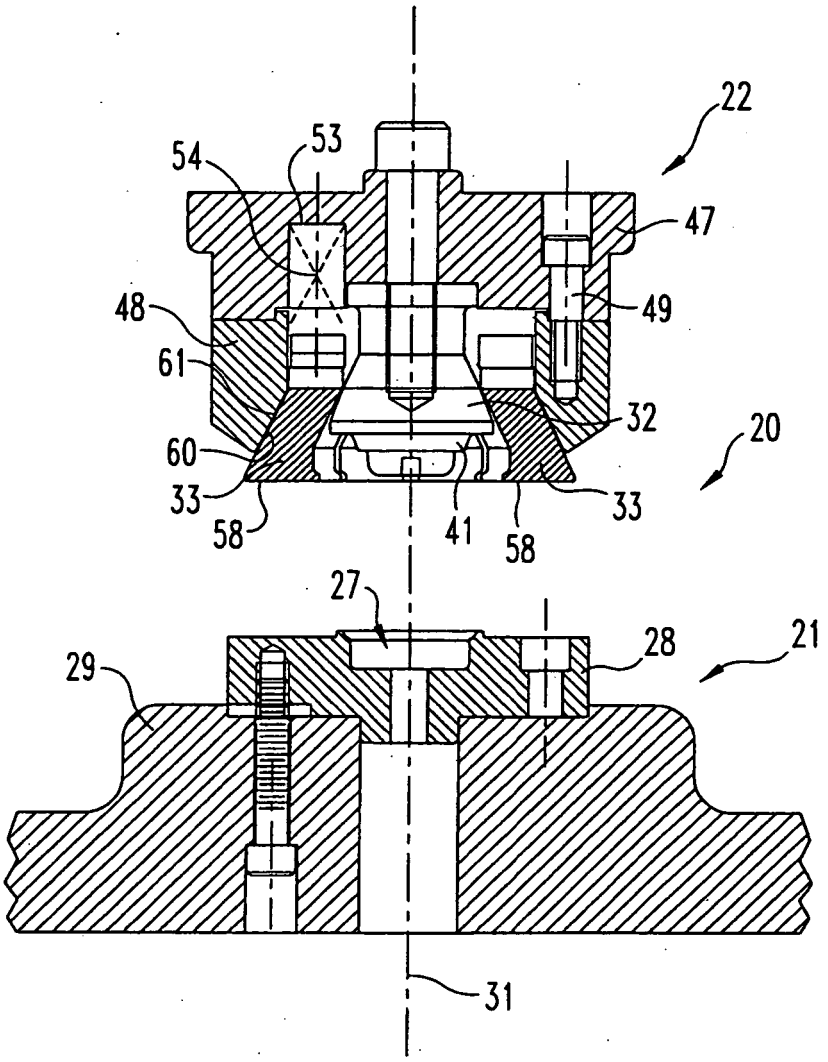

Fig. 1

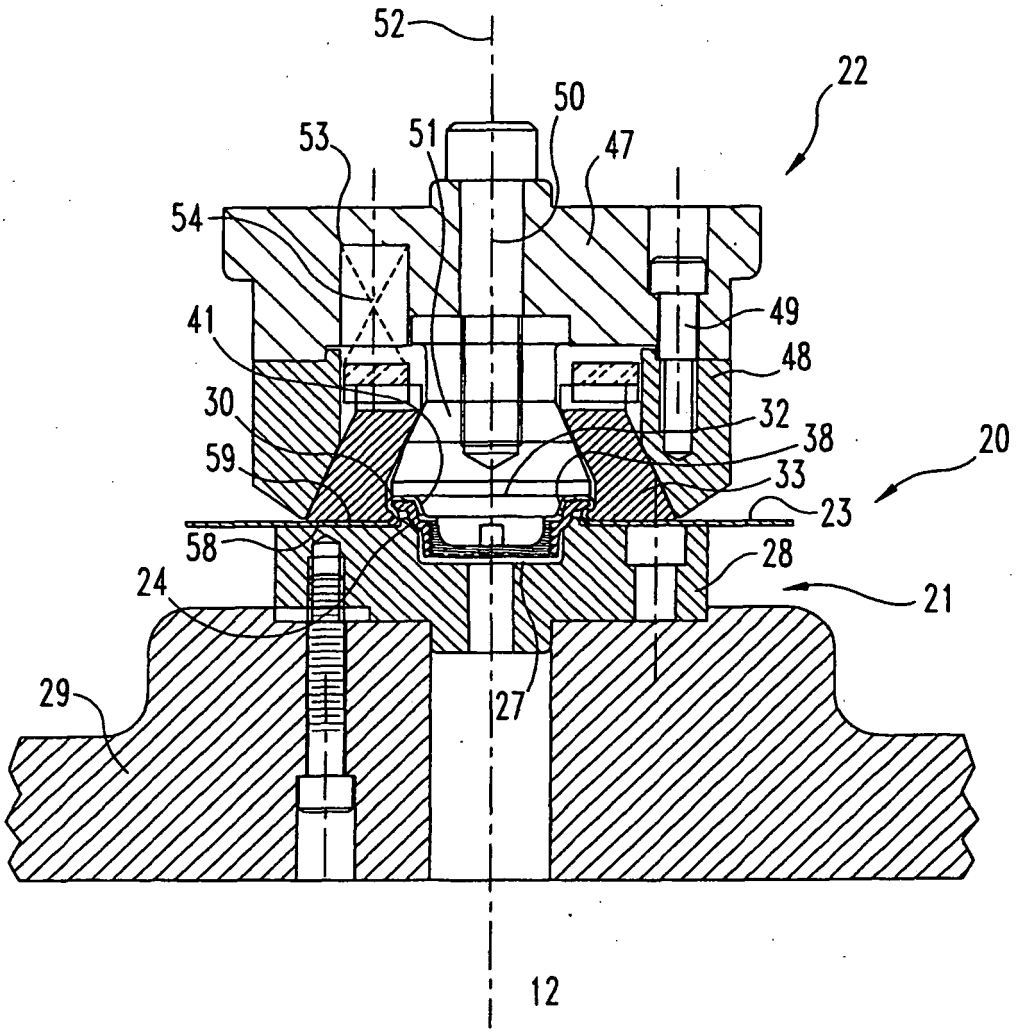

Fig. 2

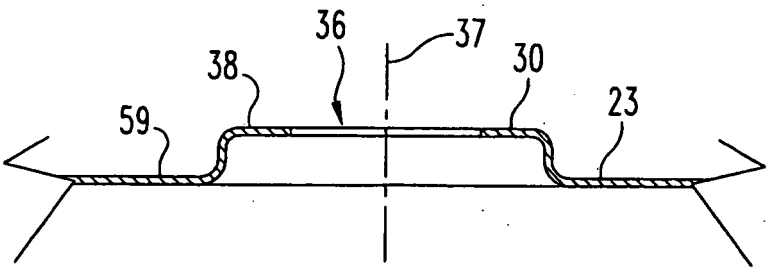

Fig. 3

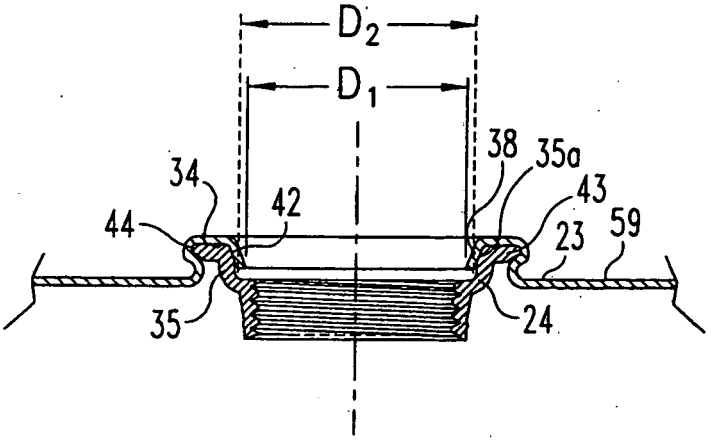

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

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